APPENDIX B

O&M OCS Source – Revolution Wind Proposed Approach

1.0 INTRODUCTION

Revolution Wind, LLC (Revolution Wind), believes the approach to OCS source determination in the O&M phase that is most consistent with the OCS rules, prior OCS air permit source determinations, and formal policy determinations is to exclude the WTGs from the OCS source in O&M (See Appendix A for discussion of this issue). However, EPA has indicated that the WTGs should be included in the OCS source in the O&M phase despite having no potential to emit any air pollutant. Revolution Wind has prepared this appendix with information reflecting an alternate approach where WTGs are not included in the OCS source. If EPA were to determine that the WTGs are not OCS sources, this appendix would serve as a tool to determine the changes to the permitting from that determination. Under this scenario, the emissions from all vessel traffic to and from the WTGs would be excluded from the Potential to Emit (PTE).

The implications of the alternate approach are discussed in this appendix in the following sections:

- Decrease in PTE of the O&M phase
- PSD applicability
- NNSR applicability
- Operating permit applicability

2.0 POTENTIAL EMISSIONS OF O&M PHASE UNDER REVOLUTION WIND APPROACH

Potential air emissions during the O&M phase which are subject to permitting under 40 CFR Part 55 when excluding WTGs as part of the OCS source are summarized in **Table 2-1**. The estimate of the Project's potential emissions during O&M differ from the estimates presented in Table 4-2 of the main application text due to fewer trips, and decreased duration of maneuvering while at, the Project OCS sources when excluding the WTGs.

Table 2-1. PTE During O&M - Revolution Wind Proposed Approach

	Applicable OCS Air Permit O&M Emissions (tpy)										
Source	**CO_2**	**CH_4**	**N_2O**	**CO_{2e}**	**CO**	**NO_X**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**	**VOC**	**Pb**
Vessels	2,748	0.02	0.1	2,783	10.1	26.8	0.03	1.2	1.2	0.6	0.0002
Equipment	350	0.005	0.00	351	0.5	1.8	0.003	0.08	0.08	0.1	0.00
Generators	171	427	0.003	0.020	1.3	3.9	0.004	0.07	0.07	0.05	0.00
Total	**3,525**	**0.025**	**0.15**	**3,566**	**11.9**	**32.5**	**0.04**	**1.4**	**1.3**	**0.8**	**0.0002**

3.0 PSD APPLICABILITY

3.1 Policy Issue #1 – Whether WTGs should be included in the OCS Source in O&M

As discussed above, Revolution Wind believes the correct approach to OCS source determination in the O&M phase is to exclude the WTGs from the OCS source because the WTGs will no longer have a potential to emit any air pollutant. This change in factual assumptions warrants revisiting the source determination basis from the Vineyard Wind and South Fork Wind (SFW) permits, which assumed WTGs would have emergency generators installed. However, EPA has indicated that the WTGs should be included in the

OCS source in O&M. Therefore, the main application presents the Project's PTE as such. **Table 3-1** presents the PTE with the WTGs excluded from the OCS source, which Revolution Wind believes is the correct approach. Because EPA has decided to treat Revolution Wind as a modification of SFW, the PTE below is compared to pollutant-specific Significant Emissions Increase thresholds, rather than the PSD threshold of 250 tpy for any New Source Review (NSR) pollutant. **Table 3-1** demonstrates that the O&M phase should not be considered a major modification of SFW.

Table 3-1. PTE Compared to PSD Thresholds - Revolution Wind Proposed Approach

Pollutant	Estimated Annual Emissions (tpy)	Significant Emission Rate (tpy)	PSD Triggered?
NO_X[1]	32.5	40	No
CO	11.9	100	No
PM_{10}	1.4	15	No
$PM_{2.5}$	1.3	10	No
SO_2	0.04	40	No
VOC	0.8	40	No
Lead	0.0002	0.6	No
GHG as CO_2e[2]	3,566	75,000	No
Sulfuric Acid Mist	None expected	7	No
Hydrogen sulfide (H_2S)	None expected	10	No
Total Reduced Sulfur	None expected	10	No
Reduced Sulfur Compounds	None expected	10	No

3.2 Policy Issue #2 – Whether the PTE of the construction and commissioning phase should be used for NNSR/PSD Applicability Evaluations for the O&M Phase

Revolution Wind asserts that the O&M phase should not be considered a major modification of SFW just because the temporary construction and commissioning phase is over one or more PSD threshold(s). While both phases are part of the Project, they are distinct in time and emissions sources. The O&M phase will not commence until the construction and commissioning phase is complete. At that time, the PTE of the construction phase will cease to be the PTE of the Project. This is analogous to a PSD source on land removing most its emission sources such that the PTE of the facility is no longer over the PSD thresholds. A source is not required to remain a PSD source in perpetuity simply because it was once a PSD source. This would be another version of EPA's 'once in always in' policy that was rescinded for major sources of HAP[1]. Revolution Wind is not aware of a similar 'once in always in' policy that EPA has applied to PSD major sources and is aware of multiple facilities that have ceased to be PSD major sources due to equipment changes of the acceptance of permit limits that reduced emissions to non-major PSD levels.

[1] The recission of the 'once in always in' policy was codified at 40 CFR Part 63 on November 19, 2020 (see https://www.federalregister.gov/documents/2020/11/19/2020-22044/reclassification-of-major-sources-as-area-sources-under-section-112-of-the-clean-air-act).

Therefore, it is Revolution Wind's position that to determine the PSD applicability of the O&M phase, the significant emissions increase thresholds should be compared to the PTE in **Table 3-1** above.

4.0 NNSR APPLICABILITY

The NNSR regulations promulgated under 40 CFR 51 specify that major modifications to an existing major source within an air quality non-attainment area must undergo a NNSR review and obtain all applicable federal and state preconstruction permits prior to commencement of construction.

NNSR permitting generally consists of:

- A LAER analysis and the installation of equipment that can achieve LAER
- Purchase of emission offsets to offset emissions of the non-attainment air pollutant
- Public comment, including an opportunity for a public hearing

The NNSR applicability thresholds are different for a new source versus a source modification. The O&M phase is not subject to NNSR when evaluating the emissions of the O&M phase separately from that of the construction and commissioning phase when excluding the WTGs from the OCS sources in O&M. Although EPA is permitting Revolution Wind as a modification of South Fork Wind, the O&M emissions in SFW's O&M phase are well below the NNSR thresholds as well. Therefore, one can argue that SFW should not be subject to NNSR source after commissioning completes. To be conservative, it is assumed that Revolution Wind would be treated as a modified NNSR source regardless.

SFW was found to be a major source for NO_X but was not found to be a major source for VOC. The major source threshold for a modified NNSR source for NOX is 25 tpy. Because SFW is a major source for NOX, the significant emissions increase threshold to compare for VOC emissions is also 25 tpy. This program is implemented under 310 CMR 7.00 Appendix A in Massachusetts as discussed further in Section 5.2.2. **Table 4-1** demonstrates that the O&M phase should not be subject to NNSR as it does not qualify as a major modification of SFW per NNSR thresholds. Therefore, as a modified NNSR source LAER would be triggered for NOX and offsets would not be required. However, if it were acknowledged that SFW emissions are below NNSR thresholds in its O&M phase and is therefore not subject to NNSR, then Revolution Wind's NOX and VOC emissions would be instead compared to 50 tpy thresholds and would not be subject to NNSR/LAER/offsets.

Table 4-1. PTE Compared to NNSR Thresholds - Revolution Wind Proposed Approach

Pollutant	Estimated Annual Emissions (tpy)	NNSR Threshold (tpy)	NNSR Triggered?
NO_X	32.55	25	Yes
VOC	0.8	25	No

5.0 MASSDEP 310 CMR 7.00 APPENDIX C

MassDEP Appendix C to 310 CMR 7.00 establishes the Major Source Operating Permit Requirements. This applies to any stationary source that directly emits or has the potential to emit, or exceeds the thresholds presented in **Table 5-1**. When comparing facility emissions to thresholds in **Table 5-1,** fugitive emissions are not included unless the facility falls into one of 28 listed source categories. The Project does

not fall into one of the listed 28 source categories; therefore, fugitive emissions are not included when comparing to the thresholds.

Potential emissions from the O&M phase do not exceed the thresholds listed in **Table 5-1** when excluding the WTGs in the OCS source. Therefore, the Project would not be required to obtain an operating permit under Appendix C.

Table 5-1. Operating Permit Facility Thresholds

Air Contaminant	Threshold Level	Potential to Emit Tons per year	Exceeds Threshold?
CO	100 tons per year	11.9	No
NOx	50 tons per year	32.5	No
PM_{10}	100 tons per year	1.4	No
$PM_{2.5}$	100 tons per year	1.3	No
SO_2	100 tons per year	0.04	No
VOC	50 tons per year	0.8	No
Pb	100 tons per year	0.0002	No

6.0 MASSDEP 310 CMR 7.02

Pursuant to 310 CMR 7.02 (5) an application for a Comprehensive Plan Approval (CPA) or Limited Plan Approval (LPA) a permit should include an air quality impact analysis and BACT analysis for any pollutant that exceeds the CPA or LPA thresholds.

The thresholds for a CPA and LPA are 10 tpy, and 1 tpy for any NSR pollutant, respectively. These thresholds are provided in **Table 6-1**, along with the PTE of the O&M phase when excluding WTGs in the OCS source. The Project does not exceed major CPA or LPA thresholds for SO_2, VOC, or Pb and therefore would not require a BACT analysis for these pollutants.

Table 6-1. PTE During O&M Compared to Massachusetts CPA and LPA Thresholds

Air Contaminant	CPA Threshold Level (tpy)	LPA Threshold Level (tpy)	Potential to Emit (tpy)	Exceeds Threshold?
CO	10	1	11.9	**Yes**
NOx	10	1	32.5	**Yes**
PM_{10}	10	1	1.4	**Yes**
$PM_{2.5}$	10	1	1.3	**Yes**
SO_2	10	1	0.04	No
VOC	10	1	0.8	No
Pb	10	1	0.0002	No

Alternative O&M Air Emissions Calculations

OM Emissions Estimates - Appendix B Approach

Project Total Emissions	Total Emissions (tons)									
Emission Type	CO2	CO2e	BC	CO	NOX	PM10	PM2.5	SO2	VOC	PB
Marine Vessels	2,748	2,783	1.00	10.1	26.8	1.22	1.20	0.033	0.6	0.00
Offshore Generators	427	432	0.1	1.3	3.9	0.07	0.07	0.004	0.05	0.00
Auxiliary Vessel Generators	350	351	0.00	0.5	1.8	0.08	0.08	0.003	0.1	0.00
TOTAL EMISSIONS	**3,525.2**	**3,566.1**	**1.1**	**11.9**	**32.5**	**1.4**	**1.3**	**0.04**	**0.8**	**0.0002**

Marine Vessel Inputs																	
Package	Vessel Type	Distance (N)	Vessel Count	Install Days	Install Hours/ Day	Mooring/ Positing	Vessel Trips	Average Vessel Speed (knots)	Main Engine Rating (kW)	Auxillary Engine Rating (kW)	In Transit (Hrs)	Propulsion Load Factor (transit)	Auxiliary Load Factor (transit)	Propulsion Hours Per Vessel (on-site)	Auxiliary Hours Per Vessel (on-site)	Propulsion Load Factor (on-site)	Auxillary Load Factor (on-site)
Planned: OSS/FOU	Crew Transport Vessel	25.0	1	180	24	Anchor			2,204	201	90	0.82	1.0	N/A	4,320	N/A	1.0
Planned: OSS/FOU	Service Operation Vessel	25.0	1		24	DP Only			6,920	201	90	0.82	1.0	780	780	0.2	1.0
Planned: WTGs/OSS/FOU	SOV Daughter Craft	25.0	1	75	24	Anchor	2	22.1	3,013	201	5	0.82	1.0	N/A	1,800	N/A	1.0
Planned: WTGs/OSS/FOU	Crew Transport Vessel	25.0	1	21.5	8	Anchor	22	22.1	2,204	201	50	0.82	1.0	N/A	172	N/A	1.0
Unplanned: WTGs/OSS	Jack-up Installation Vessel	25.0	1	12.5	24	Jackup	1	7.0	22,400	895	7	0.82	1.0	N/A	300	N/A	1.0
Planned: Cables/FOU	Survey Vessel	25.0	1	26.7	24	DP Only	1	12.5	16,637	1,363	4	0.82	1.0	13	13	0.2	1.0

Marine Vessel Speed & Engine Defaults	
StandardType	Knots
Crew	22.1
Jackup	7.0
Research/Survey	12.5

Marine Vessel Fuel Use Defaults (g/kW-	
StandardType	Main Engine
Crew	203
Jackup	203
Research/Survey	200

Marine Vessel Main Engine Emission Factors (g/kW-hr)									
Vessel Type	CO2	BC	CO	NOX	PM10	PM2.5	SO2	VOC	PB
Crew	648.2	0.231	2.30	9.15	0.310	0.300	0.006	0.137	5E-05
Jackup	647.1	0.229	2.30	10.03	0.308	0.298	0.013	0.144	5E-05
Research/Survey	638.3	0.251	2.25	9.86	0.339	0.326	0.066	0.221	4E-05
Crew / NOS Developer	648.2	0.231	2.30	7.80	0.310	0.300	0.006	0.137	5E-05
Crew / ECO Edison	648.2	0.231	2.30	1.80	0.250	0.250	0.006	0.137	5E-05

Marine Vessel Auxiliary Engine Emission Factors (g/kW-hr)									
Vessel Type	CO2	BC	CO	NOX	PM10	PM2.5	SO2	VOC	PB
Crew	648.2	0.239	2.48	10.37	0.320	0.310	0.006	0.140	5E-05
Jackup	648.2	0.239	2.48	11.55	0.320	0.310	0.006	0.140	5E-05
Research/Survey	648.2	0.239	2.48	10.21	0.320	0.310	0.006	0.140	5E-05
Crew / NOS Developer	648.2	0.239	2.48	10.37	0.320	0.310	0.006	0.140	5E-05
Crew / ECO Edison	648.2	0.239	2.48	1.80	0.250	0.250	0.006	0.140	5E-05

Marine Vessel Transit Emissions		Propulsion Emissions (tons)									Auxiliary Emissions (tons)										
Package	Vessel Type	N2O	BC	CO	NOX	PM10	PM2.5	SO2	VOC	PB	CO2	CH4	N2O	BC	CO	NOX	PM10	PM2.5	SO2	VOC	PB
Planned: OSS/FOU	Crew Transport Vessel	0.0	0.0	0.4	1.4	0.1	0.1	0.0	0.0	0.0	13	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
Planned: OSS/FOU	Service Operation Vessel	0.0	0.1	1.3	1.0	0.1	0.1	0.0	0.1	0.0	13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Planned: WTGs/OSS/FOU	SOV Daughter Craft	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Planned: WTGs/OSS/FOU	Crew Transport Vessel	0.0	0.0	0.2	0.8	0.0	0.0	0.0	0.0	0.0	7	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Unplanned: WTGs/OSS	Jack-up Installation Vessel	0.0	0.0	0.3	1.4	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Planned: Cables/FOU	Survey Vessel	0.0	0.0	0.1	0.6	0.0	0.0	0.0	0.0	0.0	3.9	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0

Marine Vessel On-Site Emissions		Propulsion Emissions (tons)									Auxiliary Emissions (tons)										
Package	Vessel Type	N2O	BC	CO	NOX	PM10	PM2.5	SO2	VOC	PB	CO2	CH4	N2O	BC	CO	NOX	PM10	PM2.5	SO2	VOC	PB
Planned: OSS/FOU	Crew Transport Vessel	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	621	0.0	0.0	0.2	2.4	9.9	0.3	0.3	0.0	0.1	0.0
Planned: OSS/FOU	Service Operation Vessel	0.0	0.3	2.7	2.1	0.3	0.3	0.0	0.2	0.0	112	0.0	0.0	0.0	0.4	0.3	0.0	0.0	0.0	0.0	0.0
Planned: WTGs/OSS/FOU	SOV Daughter Craft	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	259	0.0	0.0	0.1	1.0	4.1	0.1	0.1	0.0	0.1	0.0
Planned: WTGs/OSS/FOU	Crew Transport Vessel	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	25	0.0	0.0	0.0	0.1	0.4	0.0	0.0	0.0	0.0	0.0
Unplanned: WTGs/OSS	Jack-up Installation Vessel	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	192	0.0	0.0	0.1	0.7	3.4	0.1	0.1	0.0	0.0	0.0
Planned: Cables/FOU	Survey Vessel	0.0	0.0	0.1	0.5	0.0	0.0	0.0	0.0	0.0	12.2	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0

Marine Vessel Total Emissions		Total Emissions (tons)								
Package	Vessel Type	N2O	BC	CO	NOX	PM10	PM2.5	SO2	VOC	PB
Planned: OSS/FOU	Crew Transport Vessel	0.0	0.3	2.8	11.5	0.4	0.4	0.0	0.2	0.0
Planned: OSS/FOU	Service Operation Vessel	0.1	0.5	4.5	3.5	0.5	0.5	0.0	0.3	0.0
Planned: WTGs/OSS/FOU	SOV Daughter Craft	0.0	0.1	1.0	4.3	0.1	0.1	0.0	0.1	0.0
Planned: WTGs/OSS/FOU	Crew Transport Vessel	0.0	0.0	0.3	1.3	0.0	0.0	0.0	0.0	0.0
Unplanned: WTGs/OSS	Jack-up Installation Vessel	0.0	0.1	1.1	4.9	0.1	0.1	0.0	0.1	0.0
Planned: Cables/FOU	Survey Vessel	0.0	0.0	0.3	1.3	0.0	0.0	0.0	0.0	0.0

Offshore Generator Inputs							
Activity	Type of Equipment	Engine Count	Engine Rating (kW)	Engine Fuel Type	Fuel Sulfur Content	Hours per Engine (Hrs)	Total Hours (Hrs)
OSS/OCS Permanent Generators	Generator on OSS/OCS	2	597	Diesel	0.0015%	500	1,000

Offshore Generator Emission Factors (g/kW-hr)										
Engine Category	Engine Tier	N2O	BC	CO	NOX	PM10	PM2.5	SO2	VOC	PB
Category 1	Tier 3	0.031	0.085	2.00	5.97	0.110	0.110	0.006	0.070	0

Offshore Generator Total Emissions		Total Emissions (tons)									
Package	Engine Category	CH4	N2O	BC	CO	NOX	PM10	PM2.5	SO2	VOC	PB
OSS/OCS Permanent Generators	Category 1	0.0	0.0	0.1	1.3	3.9	0.1	0.1	0.0	0.0	0.0

Auxiliary Vessel Generator Inputs						
Package	Vessel Type	Vessel Install Days	Engine Count	Engine Rating (kW)	Time Operating (%)	Total Hours (Hrs)
Planned: WTGs/OSS/FOU	Service Operation Vessel		1	530	100%	780
Unplanned: WTGs/OSS	Jack-up Installation Vessel	13	1	5	100%	300
Unplanned: WTGs/OSS	Jack-up Installation Vessel	13	1	100	100%	300
Unplanned: WTGs/OSS	Jack-up Installation Vessel	13	1	10	50%	150

Auxilliary Vessel Generator Emission Factors (g/kW-hr)										
Eqipment Type	Engine Rating	N2O	BC	CO	NOX	PM10	PM2.5	SO2	VOC	PB
Generator Sets	100 < hp <= 175	N/A	N/A	1.12	3.99	0.2406	0.2334	0.006	0.33	N/A
Generator Sets	175 < hp <= 300	N/A	N/A	0.99	3.55	0.1976	0.1917	0.006	0.30	N/A
Generator Sets	300 < hp <= 600	N/A	N/A	1.09	3.55	0.1652	0.1603	0.006	0.24	N/A
Other General Industrial Eqp	75 < hp <= 100	N/A	N/A	1.00	2.45	0.1681	0.1631	0.006	0.12	N/A

Auxiliary Vessel Generator Total Emissions		Total Emissions (tons)										
Package	Vessel Type	CO2	CH4	N2O	BC	CO	NOX	PM10	PM2.5	SO2	VOC	PB
Planned: WTGs/OSS/FOU	Service Operation Vessel	324	0.0	N/A	N/A	0.5	1.6	0.1	0.1	0.0	0.1	N/A
Unplanned: WTGs/OSS	Jack-up Installation Vessel	1	0.0	N/A	N/A	0.0	0.0	0.0	0.0	0.0	0.0	N/A
Unplanned: WTGs/OSS	Jack-up Installation Vessel	24	0.0	N/A	N/A	0.0	0.1	0.0	0.0	0.0	0.0	N/A
Unplanned: WTGs/OSS	Jack-up Installation Vessel	1	0.0	N/A	N/A	0.0	0.0	0.0	0.0	0.0	0.0	N/A